



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/241,695 02/02/99 MIYANAGA

A SEL123

EXAMINER

MM91/0824

COOK MCFARRON & MANZO
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SUITE 2850
CHICAGO IL 60606

HILL

ART UNIT

PAPER NUMBER

2811

DATE MAILED:

08/24/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.

09/241,695

Applicant(s)

Miyana et al.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE three MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on Jun 18, 2001

2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1, 3, 5-13, and 15-55 is/are pending in the application.

4a) Of the above, claim(s) 5-13, 16, 17, 19, 20, 22, 23, 25, 26, 35-41, and 50-55 is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) 1, 3, 15, 18, 21, 24, 27-34, and 42-49 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirements.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a) ☒ All b) ☐ Some* c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☐ Notice of References Cited (PTO-892)

18) ☐ Interview Summary (PTO-413) Paper No(s). _____

16) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

19) ☐ Notice of Informal Patent Application (PTO-152)

17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____

20) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3, 15, 18, 21, 24, 27-34 and 42-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. ("Chang"; 5,893,740) in view of Ko et al. ("Ko"; 5,686,321) and/or Mikoshiba (JP 56060061 A).

Chang discloses a semiconductor IC device (Figs. 1-3), comprising MOSFETs and each of the MOSFETs comprises: a source region; a drain region; a channel forming region between the source and drain regions; an impurity region (18 or 28) being added with an impurity having an opposite conductive type to the source and drain regions and being formed under the channel forming region.

Although Chang does not explicitly disclose that the concentration of the impurity in the channel forming region is from 1/100 to 1/10 of that in the impurity region, Ko teaches (Fig. 1-4; and see col. 4, lines 11) that it is desirable to form the channel forming region (63) with a doping concentration range that covers $5 \times 10^{16} / \text{cm}^3$ through

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$1 \times 10^{17} / \text{cm}^3$ and to form the punchthrough stopper region (24) with a doping concentration range that covers $1 \times 10^{18} / \text{cm}^3$ through $1 \times 10^{19} / \text{cm}^3$, which covers a concentration ratio that is between 1/100 and 1/10. Besides, the impurity concentration of the impurity region is a well recognized parameter of importance subject to routine experimentation and optimization.

In addition, although Chang does not expressly disclose that the impurity is introduced from a direction of the $\langle 110 \rangle$ axis with respect to the single semiconductor substrate, it is noted that it is old and well known in the art that the MODFET can be formed with the wafer surface being parallel to the (100) crystal plane and with the channel being aligned to $\langle 100 \rangle$ crystal direction for minimizing the adverse piezo effect, as evidenced in Mikoshiba (Fig. 1), which compress a gate (5) aligned along a {100} direction on a (100) substrate.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor device of Chang with the concentration of the impurity in the channel forming region being from 1/100 to 1/10 of that in the impurity region and with the wafer surface being parallel to the (100) crystal plane and with the channel being aligned to $\langle 100 \rangle$ crystal direction, as taught in Ko and Mikoshiba, so that a device with faster switch speed, increased punchthrough voltage and minimized piezo effect would be achieved. And, in such a device taught by Chang in view of Ko and/or Mikoshiba, the impurity doping direction would be inherently along

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the <110> direction, as the arrow direction shown in Fig. 3C of Chang is about 45 degrees to the vertical, which would be inherently perpendicular to a plane having the smallest atomic density of the single semiconductor substrate. In addition, it is noted that the exact doping direction for the impurity regions is also a well recognized parameter of importance subject to routine experimentation and optimization

Regarding claim 29, Chang's semiconductor device further comprises a pair of LDD region (14).

Regarding claims 18, 21, 24, 29-33 and 44-47, it is noted that it is old and well known in the art that semiconductor devices having MOSFETs with short channels can be used in microprocessors, including RISC or ASIC ones, and can be applied in cellular phones, personal handy phone systems and portable computers. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to make the semiconductor device and apply it to the above areas for achieving improved performance/cost combination in these areas.

Regarding claim 27, 34 and 48, Chang further discloses that the peak impurity region is formed at a depth of from 50 to 60 nm (Col. 3, lines 58 and 59).

Regarding claim 28, it is noted that Chang's MOSFET is a bulk one on silicon substrate; and, a bulk MOSFET is normally formed with a single crystal substrate.

Regarding claims 42 and 43, it is noted that Chang discloses that the device can be a COMS (col. 5, lines 1-10) and that Ar, P and B are all well known dopants.

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Response to Arguments

3. Applicant's arguments filed on 6/18/2001 have been fully considered but they are not persuasive.

In response to applicant's argument that none of Chang, Ko and Mikoshiba teaches that the impurity is introduced from a direction perpendicular to a plane having the smallest atomic density of the single semiconductor substrate, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). As noted in the obviousness rejection set forth in this Office action, the implantation direction in the device taught by Chang in view of Ko and/or Mikoshiba would be inherently along the <110> direction, which in turn would be inherently perpendicular to a plane having the smallest atomic density of the single semiconductor substrate.

Conclusion

4. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

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TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

5. Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 or 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Shouxiang Hu** whose telephone number is **(703) 306-5729**. The examiner can normally be reached on Tuesday through Friday from 7:30 AM to 5:00 PM.

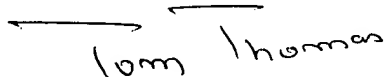
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax

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phone number for the organization where this application or proceeding is assigned is
(703) 308-7724.

Any inquiry of a general nature or relating to the status of this application should
be directed to the **Technology Center Receptionists** whose telephone number is
(703) 308-0956.

Shouxiang Hu
August 21, 2001


TOM THOMAS
SUPERVISORY PATENT EXAMINER